Claims

1.   Method for pre-emphasing an optical multiplex signal (OS)
      which features a number of signals with different
      wavelengths which are transmitted from a transmitter to a
5   receiver, in which powers of the signals are set at the
      transmitter and also measured at the receiver,
characterized in that
      an average power is determined for the send-side signals,
      from the current powers of the signals at the transmitter
10   and at the receiver and the average power new signal values
      are determined and set on the send side, such that at the
      receiver signal-to-noise ratios of all signals are almost
      equalized.

2.   Method in accordance with claim 1,
15 characterized in that
      for a new setting of the signals at the transmitter
      spectral influences of the transmission link between the
      transmitter and the receiver, preferably as a result of
      amplification, noise influences, attenuation are taken into
20   consideration.

3.   Method in accordance with one of the previous claims
characterized in that
      for an optical transmission over N+1 optical amplifiers
      connected in series with similar amplification
25   characteristics and over N transmission links connected
      between the amplifiers, the new power to be set
      ($P_{IN}(\lambda)\_new$) of one of the signals is calculated as
      follows:

$$P_{IN}(\lambda) \_ new := <P_{IN}> \cdot \frac{Q(\lambda)}{<Q(\lambda)>} \quad \{in\ mW\}$$

with ($<P_{IN}>$) designating the average power of a signal at the transmitter and for tolerated balance of the signal-to-noise ratios the function $Q(\lambda)$ is defined as follows:

$$\frac{Q(\lambda)}{<Q(\lambda)>} = k \frac{f(\lambda)}{\lambda} \cdot \frac{1}{N+1} \cdot \frac{G_{LINK} - 1}{G_{LINK}^{\frac{N}{N+1}} \cdot \left[G_{LINK}^{\frac{1}{N+1}} - 1\right]}$$

5   with (G_{LINK}) being the overall gain of a channel determined from the signal powers (P_{IN}, P_{OUT}) at the transmitter and the receiver and $f(\lambda)$ as spectral number function of the optical amplifier and K as constant.

4.   Method in accordance with claim 2 or 3,

10   characterized in that

the function $Q(\lambda)/<Q(\lambda)>$ is approximated by $1/\sqrt{G_{LINK}}$.

5.   Method in accordance with claim 1 or 2, characterized in that

the normalized power spectrum of the signal at the

15   transmitter and at the receiver form inverse functions to each other.

6.   Method in accordance with claim 1 or 2, characterized in that

the new power to be set ($P_{IN}(\lambda)\_new$) of a signal at the

20   transmitter is calculated by means of the following formula:

$$P_{IN}(\lambda) \_ new := < P_{IN} > \cdot \sqrt{\frac{P_{IN}(\lambda)}{P_{OUT}(\lambda)}} \cdot \sqrt{\frac{< P_{OUT} >}{< P_{IN} >}} \qquad \{in\ mW\}$$

with pointed brackets $<...>$ designating an averaging of an argument over the bandwidth ($\Delta\lambda$) of the signals, ($P_{IN}(\lambda)$)

25   the currently determined power of a signal at the

transmitter, $(P_{OUT}(\lambda))$ the measured power of a signal at the receiver and (k) a constant with O<k<1.

7. Method in accordance with claim 6, characterized in that

5   an optimum of the constant (k) is selected such that minimum system-related deviations of the signal-to-noise ratios occur.

8. Method in accordance with one of the claims 6 or 7, characterized in that

10   the constant (k) is selected by means of a planning tool preferably of a network management and/or by means of measurements of signal-to-noise ratios.

9. Method in accordance with one of the previous claims characterized in that

15   for control purposes, signal-to-noise ratios of selected signals or groups of signals at the transmitter and at the receiver are determined.

10. Method in accordance with one of the previous claims characterized in that

20   the transmitter and receiver contain optical amplifiers.

11. Method in accordance with one of the previous claims characterized in that

         the transmission link between the transmitter and the receiver is provided as a part link of a optical network

25   and

         that for each part link a pre-emphasis is performed.

12. Method in accordance with one of the previous claims characterized in that

         the new power to be set(PIN(λ) new) of a signal at the

30   transmitter of a part link is set by means of the following

formula:

$$P_{IN}(\lambda)\_new = (P_{IN}) \cdot \frac{G(\lambda)^{-k}}{\langle G(\lambda)^{-k} \rangle} \cdot \frac{OSNR^{IN}(\lambda)}{OSNR^{IPP}} \cdot \frac{h(\lambda)}{OSNR^{IN}(\lambda) \cdot \alpha - h(\lambda)},$$

with the optical signal-to-noise ratio value ($OSNR^{PP}$)

standing for that constant signal-to-noise ratio, which

would be produced in standalone operation of the

transmission link in the network, and with ($G(\lambda)$)

designating the wavelength-dependent gain of the

transmission link considered and with ($h(\lambda)$) designating a

desired wavelength-dependent function of the signal-to-

noise ratios at the end of the part link and

with the parameter (α) being selected so that the average

power $<P_{in}>$ of the channels at the input of the part link

remains unchanged and

with ($OSNR^{IN}(\lambda)$) designating the wavelength-dependent

signal-to-noise ratios at the input of the part link.

13. Method in accordance with one of the previous claims
characterized in that
    fully optical transparent networks are used for the
    transmission of the signals.

14. Method in accordance with one of the previous claims
characterized in that
    for a DWDM transmission spectral spacings between the
    channels occupied by the signals at or anywhere below 100
    GHz are selected.

15. Method in accordance with one of the previous claims
characterized in that
    an additional pre-emphasis of the powers of the signals at
    the transmitter is used for setting signal-to-noise ratios
    of the signals measured at the receiver.

16. Method in accordance with one of the previous claims,
characterized in that,
tilting or non-linear deviations of the spectrum of the
signal-to-noise ratios are compensated for.

5   17. Method in accordance with one of the previous claims
characterized in that
for a transmission link with a number of downstream optical
amplifiers (V1, V2, V3, V4) and optical wave guides (LWL1,
LWL2, LWL3) the optical amplifiers (V1, V2, V3, V4) can be
10   activated or regulated such that the increase of the
optical power spectrum at the input of each amplifier (V1,
V2, V3, V4) has a predetermined value.

18. Method in accordance with claim 17,
characterized in that
15   this prespecified value corresponds to the tilt of a
predetermined noise figure.